Advanced Net Flux Radiometer Focal Plane Assembly for Ice Giants

Completed Technology Project (2018 - 2021)

Project Introduction

The recent Ice Giants Pre-Decadal Survey Mission Report, 2017 (IGPDS) recommended the scientific importance and high priority of sending a mission with an orbiter and a probe to one of the ice giants with preferential launch dates in the 2029-2034 timeframe. Such a mission will advance our understanding of the Solar System, exoplanetary systems, planetary formation and evolution. The IGPDS report identified twelve science objectives for ice giant exploration that are consistent with the Vision and Voyages Planetary Science Decadal Survey (NRC 2011). Highlighted in the report are two science objectives, of equal importance, that relate to the atmospheric (thermal) structure of these icy worlds: (i) determine the planet's atmospheric heat balance, and (ii) determine the planet's tropospheric 3-D flow. Key questions concerning the atmospheric structure arise: What are the altitudes/pressures and compositions of the cloud layers? How do the cloud layers interact with solar visible and planetary thermal radiation to influence the atmospheric energy balance? How does the energy balance contribute to atmospheric dynamics? Our unique Net Flux Radiometer (NFR) concept, onboard a probe descending deep into the atmosphere will contribute greatly to answering these questions by measuring the upward and downward radiation flux, in seven spectral channels, each with a 5-degree Field-Of-View (FOV) and in five sequential view (sky) angles as a function of altitude/pressure. We will develop a prototype advanced Focal Plane Assembly (FPA) housed in a vacuum micro-vessel, a key sub-system of our NFR. The design, build and validation of this sub-system will mature this technology from TRL-2 to TRL-4. We propose to develop an advanced NFR FPA, comprising integrated detector and Winston cone sub-assemblies, housed inside a vacuum micro-vessel. The vacuum micro-vessel is required to help mitigate the effects of rapid changes in temperature of the FPA that the instrument will experience during a probe descent into either a Uranus or a Neptune atmosphere. The FPA will be integrated with a fold mirror sub-assembly and assembled into a vacuum micro-vessel to mature this technology from TRL-2 to TRL-4. Our proposal team collectively has decades of experience in designing and building mid-infrared to far-infrared instrumentation and are uniquely qualified to carry out this work.

Anticipated Benefits

This project will increases the technology readiness level of a novel net flux radiometer focal plane assembly for inclusion in instrumentation onboard a future Ice Giants Probe Mission

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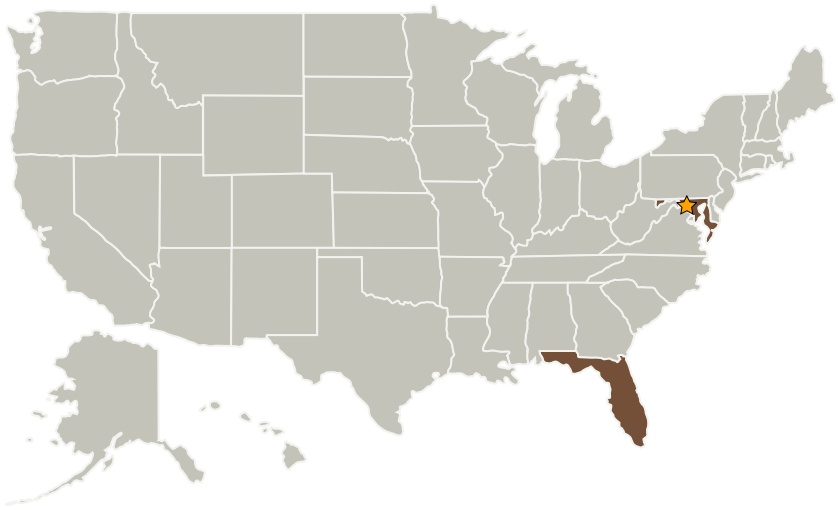
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Atmospheric, Oceanic and Planetary Physics	Supporting Organization	Industry	
University of Maryland-College Park(UMCP)	Supporting Organization	Academia Asian American Native American Pacific Islander (AANAPISI)	College Park, Maryland

Primary U.S. Work Locations	
Florida	Maryland

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Planetary Instrument Concepts for the Advancement of Solar System Observations

Project Management

Program Director:

Carolyn R Mercer

Program Manager:

Haris Riris

Principal Investigator:

Shahid Aslam

Co-Investigators:

Geronimo L Villanueva
Richard K Achterberg
David T Leisawitz
Gerard T Quilligan
Tilak Hewagama
Conor A Nixon
Patrick G Irwin
Valeria Cottini
Nicolas J Gorius
Amy A Simon

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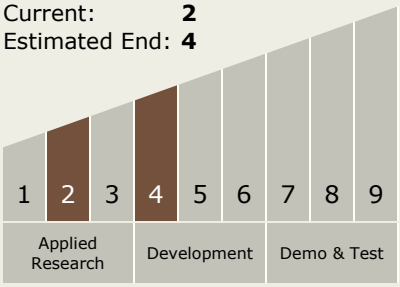
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Others Inside the Solar System